

# INTERNATIONAL SEARCH REPORT

International Application No  
PCT/EP2005/000320

<b>A. CLASSIFICATION OF SUBJECT MATTER</b> IPC 7 G03F7/20 G02B27/28 G02B5/30		
According to International Patent Classification (IPC) or to both national classification and IPC		
<b>B. FIELDS SEARCHED</b> Minimum documentation searched (classification system followed by classification symbols) IPC 7 G02B G03F G02F		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practical, search terms used) EPO-Internal, WPI Data, PAJ		
<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	GB 856 621 A (NATIONAL RESEARCH DEVELOPMENT CORPORATION) 21 December 1960 (1960-12-21) page 3, line 11 - line 20; figure 4	1-8
Y	US 5 867 315 A (KOIKE ET AL) 2 February 1999 (1999-02-02) abstract column 10, line 5 - line 29 column 11, line 24 - line 31; figure 10	1-8
X	US 3 630 598 A (WILLIAM S. LITTLE JR) 28 December 1971 (1971-12-28)	32
A	column 4, line 45 - line 67	33-55
<input type="checkbox"/> Further documents are listed in the continuation of box C. <input checked="" type="checkbox"/> Patent family members are listed in annex.		
* Special categories of cited documents : "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art. "&" document member of the same patent family		
Date of the actual completion of the international search 9 August 2005		Date of mailing of the international search report 20.09.2005
Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016		Authorized officer Michel, A

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### Box II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
  
2. ☐ Claims Nos.:  
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
  
3. ☐ Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a):

### Box III Observations where unity of invention is lacking (Continuation of Item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☒ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:  
1-55
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☒ No protest accompanied the payment of additional search fees.

## FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-31

Claim 1 relates to a polarization-modulating optical element comprising an optically active crystal having an optical axis (claims 2-31 are dependent thereupon).

The problem to be solved is how to rotate the oscillation plane of the electrical field vector of linearly polarized light by an angle proportional to the distance travelled in said crystal.

The special characteristic is the thickness profile being variable along said optical axis.

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2. claims: 32-55

Claim 32 relates to a polarization-modulating optical element comprising an optically active crystal (claims 33-55 are dependent thereupon).

The problem to be solved is how to produce an arbitrarily selected distribution of the oscillation planes of the electrical field vector of linearly polarized light traversing said crystal.

The special characteristic is the two different angles at which two different linearly polarized light rays are rotated.

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3. claim: 56

Claim 56 relates to a method for manufacturing a micro-structured semiconductor component.

The problem to be solved is how to increase the achievable resolution by enabling immersion microlithography technique. The special method step is using a projection system where a polarization modulating optical element comprising an optically active crystal is arranged in its illumination system.

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4. claims: 57-64

Claim 57 relates to an optical system having an optical axis and a polarization modulating element comprising an optically active material (claims 58-64 are dependent thereupon).

The problem to be solved is how to... produce a tangential polarization distribution.

The special characteristic is the effective thickness profile being variable in a direction non parallel to said optical axis.

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## FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

## 5. claims: 65-74

Claim 65 relates to an optical system having an optical axis and a polarization modulating element (claims 66-74 are dependent thereupon).

The problem to be solved is how to thermally control the change of polarization.

The special characteristics are the:

- effective thickness profile being constant along the optical axis of a solid and/or liquid optically active material therein;
  - polarization control system having a heating or cooling device.
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## 6. claims: 75-80

Claim 75 relates to an optical system having an optical axis and two polarization modulating elements (claims 76-80 are dependent thereupon).

The problem to be solved is how to athermalise the system.

The special characteristics are the:

- two polarization modulating elements having optically active materials with specific rotations of opposite signs; and
  - effective thickness profile of one polarization modulating element being variable in a direction non parallel to the optical axis of a solid and/or liquid optically active material therein; and/or
  - effective thickness profile of one polarization modulating element being constant in a direction non parallel to the optical axis of a solid and/or liquid optically active material therein.
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## 7. claim: 81

Claim 81 relates to a method for manufacturing micro-structured semiconductor components.

The problem to be solved is how to control the change of polarization by Faraday effect.

The special method step is using a projection system comprising a polarization modulating optical element having optically active or inactive material subjected to a magnetic field.

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# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/EP2005/000320

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
GB 856621	A	21-12-1960	NONE	
US 5867315	A	02-02-1999	JP 3534363 B2 JP 9043401 A	07-06-2004 14-02-1997
US 3630598	A	28-12-1971	BE 761134 A1 DE 2064649 A1 FR 2075915 A5 GB 1330709 A JP 49031665 B NL 7100036 A	30-06-1971 22-06-1972 15-10-1971 19-09-1973 23-08-1974 06-07-1971